BENDER

Operating Manual

RCM420-DM
RCM420-DM1C
RCM420-DM2C
RCM420-DM3C

Residual current monitor
for AC current monitoring in TN and TT systems
with an analogue interface
Software version: D240 v1.1x

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BENDER Group

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1. Effective use of this manual

1.1 Notes for the user

This manual is intended for experts in electrical engineering and electronics!

In order to make it easier for you to find specific text passages or references in this manual and for reasons of comprehensibility, important information is emphasized by symbols. The meaning of these symbols is explained below:

Information intended to assist the user to make optimum use of the product are marked with the Info symbol.

Information calling attention to hazards are marked with this warning symbol.

1.2 Intended use

The AC and pulsed DC sensitive residual current monitor RCM420 (Type A) from Bender is designed for fault and residual current monitoring in earthed power supply systems (TN/TT systems) where an alarm is to be activated in the event of a fault, but disconnection must be prevented. In addition, the device can be used to monitor single conductors, such as PE conductors, N-PE connections and PE-PAS connections.
Two separately adjustable response ranges $I_{\Delta n1}$ and $I_{\Delta n2}$ allow to distinguish between prewarning and alarm ($I_{\Delta n1}$ = 50…100 % of the set response value $I_{\Delta n2}$).

1.3 Information about factory setting

Seite 40 provides a summary of all factory settings.
If you want to reset the residual current monitor to factory settings, refer to Seite 39.

2. Safety information

2.1 Safety instructions

In addition to this data sheet, the documentation of the device includes a sheet entitled "Important safety instructions for BENDER products".

2.2 Work activities on electrical installations

- All work activities necessary for installation, commissioning or work activities during operation of electrical devices or systems are to be carried out by adequately skilled personnel.
- Observe the relevant regulations applying to work on electrical installations, in particular DIN EN 50110 or its subsequent regulation.

Unprofessional work activities on electrical installations may result in a threat of danger to life and limb!

- If the equipment is used outside the Federal Republic of Germany, the respective national standards and regulations are to be observed. The European standard EN 50110 is recommended to be used as a directive.

3. Function

3.1 Device features

- AC and pulsed DC sensitive residual current monitor Type A according to IEC 62020
- Analogue interface configurable acc. to response value or configurable
- Adjustable switching hysteresis
- r.m.s. value measurement
- Starting delay, response delay and delay on release
- Measured value display via multi-functional LC display
- Alarm indication via LEDs (AL1, AL2) and one changeover contact
- N/C operation or N/O operation selectable
- Password protection against unauthorized parameter changing
- Fault memory behaviour selectable
- CT connection monitoring

3.2 Function

Once the supply voltage U_s is applied, the starting delay "t" is activated. Measured values exceeded during this time do not influence the switching state of the alarm relays. Residual current monitoring takes place via an external measuring current transformer. The currently measured value is shown on the LC display. In this way any changes can be recognized easily, for example, when circuits are connected to the system. If the measured value exceeds one or both response values, the response delay $t_{on1/2}$ starts running. After the expiry of the response delay $t_{on1/2}$, the selected alarm relay switches and the alarm LEDs light. In addition, an analogue alarm is output for further processing, for example, a current of 0...20 mA. If the release value is not reached before the response delay t_{on} has elapsed, no alarm will be signalled: the LEDs AL1, AL2 do not light and the alarm relay does not switch. The set release time t_{off} begins when the measured value again falls below the release value (re-

sponse value minus hysteresis) after the switching of the alarm relays. When the delay time "t_{off}" has elapsed, the alarm relays switch back to their initial position. With the fault memory activated, the alarm relays do not change their actual state until the reset button R is pressed. The device function can be tested using the test button T. The parameterization of the device can be carried out via the LC display and the function keys integrated in the front plate and can be password-protected.

3.2.1 Connection monitoring

The CT connections are continuously monitored. In the event of a fault, the alarm relays K1 / K2 switch, the alarm LEDs AL1 / AL2 / ON flash (Error Code E.01). After eliminating the fault, the alarm relays automatically return to their initial position, provided that the fault memory M is deactivated. With the fault memory activated, K1/K2 return to their initial position by pressing the reset button R. A second cascaded measuring current transformer will not be monitored.

3.2.2 Additional cascaded measuring current transformer

For applications where residual currents higher than 10 A occur, a second external transformer can be cascaded. The transformer's transmission ratio can be adapted using the correction factor n_{RCM} in the SEt menu. Refer to Seite 20 and Seite 37.

3.2.3 Fast response value query

With the display in standard mode, the currently measured response values $I_{\Delta n1}$ and $I_{\Delta n2}$ can be queried pressing the Up and Down keys (< 1.5 s). Switchover to the Menu mode is not required. If you want to exit the fast response value query, press the enter key.

3.2.4 Automatic self test

The device automatically carries out a self test after connecting to the system to be monitored and later every 24 hours. During the self test internal functional faults will be detected and appear in form of an error code on the display. The alarm relays are not checked during this test.

3.2.5 Manual self test

After pressing the test button for > 1.5 s, the device carries out a self test. During this test, internal functional faults are detected and will be displayed in form of an error code. The alarm relays are switched during the self test.
While the test button T is pressed and held down, all device-related display elements appear on the display.

3.2.6 Functional faults

If an internal functional fault occurs, all three LEDs flash. An error code will appear on the display (E01...E32).
For example, E08 means: Incorrect internal calibration. In such a case please contact the Bender Service.

3.2.7 Preset the number of reload cycles

If a fault occurred in the system being monitored and the system would be disconnected by the alarm relays, the alarm relays would switch on and off, provided that the fault memory M is deactivated.
RL in the out menu can be used to limit the number of these changeover processes. As soon as the preset number of switching cycles is exceeded, the fault memory will come on and an activated alarm remains stored.

3.2.8 Assigning alarm categories to alarm relay K2

The alarm categories device error, residual current $I_{\Delta n1}$, residual current $I_{\Delta n2}$ or alarm by device test can be assigned to the alarm relay via the "out" menu.

3.2.9 Time delays t, t_{on} and t_{off}

The times t, t_{on} and t_{off}, described below, delay the output of alarms via LEDs and relays.

3.2.10 Starting delay t

After connection to the supply voltage U_S, the alarm indication is delayed by the preset time t (0...10 s).

3.2.11 Response delay t_{on2}

If the response value is exceeded or not reached, the residual current monitor requires the response time t_{an} until an alarm is signalled.
A preset response delay t_{on2} (0...10 s) adds up to the device-related operating time t_{ae} and delays alarm signalling (total delay time $t_{an} = t_{ae} + t_{on}$).
If the residual current fault changes from a value above the response value to a value below the response value before the response delay has elapsed, an alarm will not be signalled.

3.2.12 Delay on release t_{off}

When the alarm no longer exists and the fault memory is deactivated, the alarm LEDs go out and the alarm relays switch back to their initial position. When the delay on release (0...99 s) has been preset, the alarm state is continuously maintained for the selected period.

3.2.13 Residual current monitoring in window discriminator mode

Change the measuring principle by selecting the window mode .(SEt / In). In the window discriminator mode, the threshold values I1 and I2 represent the upper and the lower value. If the measured value is not within this area, an alarm is initiated by the device. See Seite 37.

3.2.14 Password protection (on, OFF)

When password protection is activated (on), settings can only be carried after entering the password (0...999).

3.2.15 Factory setting FAC

After activating the factory setting, all settings previously changed are reset to delivery status.

3.2.16 Erasable history memory

The first alarm value that occurs will be saved in this memory. The memory can be cleared via the menu HiS.

3.2.17 External, combined test resp. reset button T/R

Reset = Pressing the external button < 1.5 s
Test = Pressing the external button > 1.5 s

3.2.18 Interface options

The device provides the following options:
M, M1C, M2C or M3C.

Option M

This option provides an analogue interface **with** galvanic isolation. One of three output signals can be selected from the associated menu. Only use the output you have selected via the software:

- DC 0...400 µA
  Current output for BENDER measuring instruments of the 96.. series.
- DC 0/4...20 mA
  Standardized current output with selectable current ranges.
- DC 0...10 V
  Standardized voltage signal.

The following interface options include the changeover contact K2 to signal an additionally occurring alarm.

Option M1C

This option provides an analogue interface **without** galvanic isolation:

- DC 0/4...20 mA
  Standardized current output with selectable current ranges.

Option M2C

This option provides an analogue interface **without** galvanic isolation:

– DC 0...400 µA
  Current output for BENDER measuring instruments of the 96.. series.

Option M3C

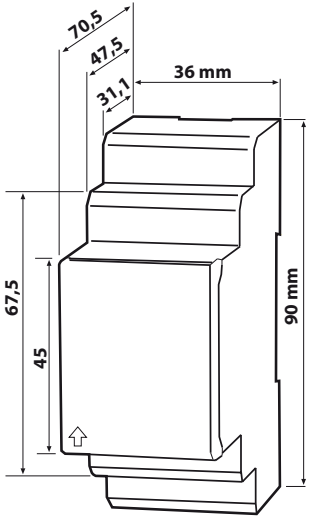
This option provides an analogue interface **without** galvanic isolation:

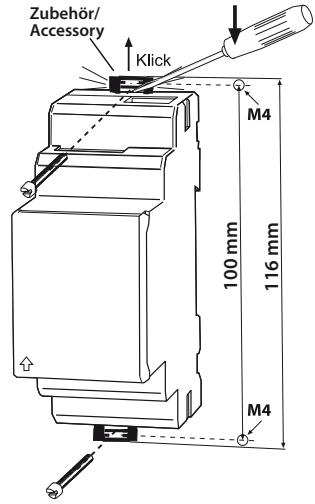
– DC 0...10 V
  Standardized voltage signal.

4. Installation and connection

Ensure safe isolation from supply in the installation area. Observe the installation rules for live working.

General dimension diagram and drawing for screw fixing

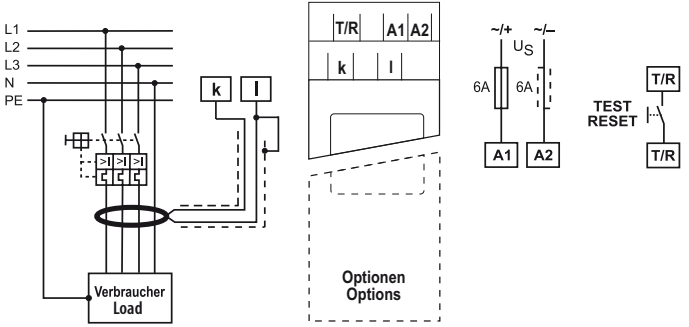




The front plate cover is easy to open at the lower part marked by an arrow.

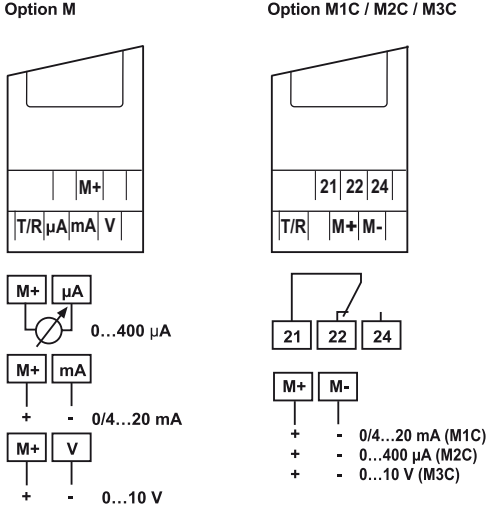
1. **DIN rail mounting:**
   Snap the rear mounting clip of the device into place in such a way that a safe and tight fit is ensured.
   Screw fixing:
   Use a tool to move the rear mounting clips (a second mounting clip required, see ordering information) to a position that it projects beyond the enclosure. Then fix the device using two M4 screws.

2. **Wiring**
   Connect the device according the wiring diagram.



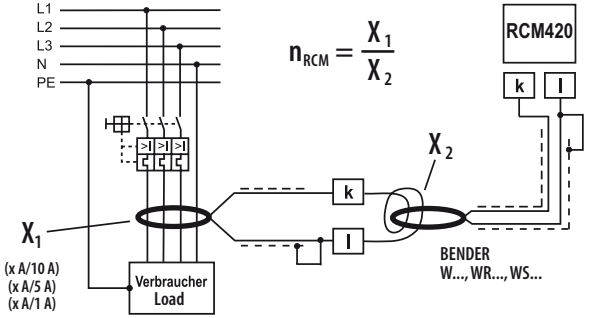
When connecting the device, it is important to consider the respective device variant (interface option).

Terminal	Connections
A1, A2	Connection to supply voltage U_s
k, l	Connection of measuring current transformers
T/R	Connection to the combined test and reset button
21, 22, 24	Alarm relay K2
M+, M-	(common) positive pole of the analogue interface, negative pole of the analogue interface
µA	Current output 0...400 µA
mA	Current output 0/4...20 mA
V	Voltage output 0...10 V



Connection of an additional cascaded measuring current transformer

If the residual current range of 16 A is not sufficient, an additional measuring current transformer can be cascaded. Connect the measuring current transformer as illustrated in the drawing below.



Example:
An additionally cascaded transformer on the load side has a transmission ratio of $X_1 = 100$ (500 A / 5 A). That means, when the lowest value of 10 mA is set at the RCM420, a current of 1 A can only just be detected on the primary side of the transformer on the load side. In order to reduce the value that can be detected to 100 mA, 10 turns of the supply cable has to be routed through the transformer on the RCM side.
Hence, the correction factor to be set is
$n_{RCM} = X_1/X_2 = 100/10 = 10$.
The correction factor can be set via the SEt/n menu. Refer to Seite 37.

The correction factor is factory set to 1 and relates to normal operation with one BENDER measuring current transformer only (X = 600:1).

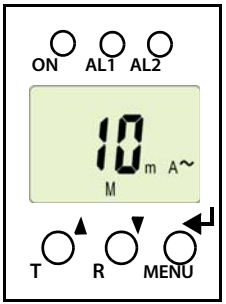
5. Operation and setting

5.1 Display elements

A detailed description of the meaning of the display elements is given in the table below.

Display elements	Element	Function
	**RL**	Reload function with memory = off (L = l.)
	n	Setting the correction factor for an additional cascaded current transformer.
	I2	Response value $I_{\Delta n2}$ as mA (Alarm 2)
	I1	Response value $I_{\Delta n1}$ as % of $I_{\Delta n2}$ (Alarm 1, prewarning)
	r2, 2	Alarm relay K2
	I Hys, %	Response value hysteresis as %
	ton2, t, toff	Response delay t_{on2} (K2) Starting delay t, Delay on release t_{off} for K2
	M	Fault memory active
		Relay operating mode K2
		Password protection enabled

5.2 Function of the operating elements

Device front	Element	Function
	**ON, green**	lights continuously: Power On LED flashes: System fault or connection monitoring fault
	AL1, **AL2**	LED Alarm 1 lights(yellow): Response value 1 reached ($I_{\Delta n1}$) LED Alarm 2 lights (yellow): Response value 2 reached ($I_{\Delta n2}$)
	10 mA **M**	10 mA flow through the current transformer, fault memory active
	T, ▲	Test button (> 1.5 s): To view the available display elements, to start a self test; Up key (< 1.5 s): Menu items/values
	R, ▼	Reset button (> 1.5 s): Deleting the fault memory; Down key (< 1.5 s): Menu items/values
	MENU, ↵	MENU key (> 1.5 s): Starting the menu mode; Enter key (< 1.5 s): Confirm menu item, submenu item and value. Enter key (> 1.5 s): Back to the next higher menu level.

5.3 Menu structure

All adjustable parameters are listed in the columns "menu item" and "adjustable parameters". A display-like representation is used to illustrate the parameters in the column menu item.

5.3.1 Menu structure of the M1C, M2C, M3C options

Different alarm categories can be assigned to the alarm relays K2 via the submenu r2. This is done by activation or deactivation of the respective function.

Menu	Sub Menu	Menu item	Activation	Adjustable parameter
AL (response - values)	→	> I2	- (HI)	$I_{\Delta n2}$ (Alarm 2)
		> I1	- (HI)	$I_{\Delta n1}$ as % of $I_{\Delta n2}$ (Alarm 1, prewarning)
		Hys	-	Hysteresis $I_{\Delta n1}$ / $I_{\Delta n2}$
out (output control)	→	M	-	Fault memory
		2	-	Operating mode K2 (n.c.)
		RL	-	Reload function (memory = off)
		I	-	**Option M1C only:** 0...20 or 4...20 mA, selectable
	r2 (K2: (assignment alarm category)	2 Err	ON	Device error at K2
		r2 I1	off	Prewarning I1 at K2
		r2 I2	ON	Alarm I2 at K2
		2 tES	ON	Device test
	AnA Analogue outp.: 100% reference value	I2 AL	-	100 % value related to response value I2 (Alarm 2)
		I	-	100 % value related to the user-defined current value

Menu	Sub Menu	Menu item	Activation	Adjustable parameter
t (timing check)	→	t on 2	-	Response delay K2
		t	-	Starting delay
		t off	-	Delay on release K2
Set (device control)	→	I 12	HI	Selectable parameters: High, window function, low
		n	1	Setting the correction factor for an additional cascaded current transformer.
		🔒	off	Parameter setting via password
		FAC	-	Re-establish factory settings
		SYS	-	Function blocked
InF	→		-	Display hard / software version
HiS	→	Clr	-	History memory for the first alarm value, erasable

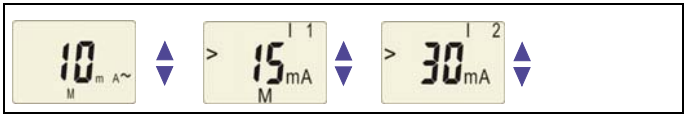
5.3.2 Menu structure option M

Menu	Sub Menu	Menu item	Activation	Adjustable parameter
AL (response values)	→	> I2	- (Hi)	$I_{\Delta n2}$ (Alarm 2)
		> I1	- (Hi)	$I_{\Delta n1}$ as % of $I_{\Delta n2}$ (Alarm 1, prewarning)
		Hys	-	Hysteresis $I_{\Delta n1}$ / $I_{\Delta n2}$
out (output control)	→	M	-	Fault memory
		I, U	-	Selection current / voltage 0...20 or 4...20 mA
	AnA Analogue outp.: 100 % reference value	I2 AL	-	100 % value related to response value I2 (Alarm 2)
		I	-	100 % value related to the user-defined current value I
t (timing check)	→	t	-	Starting delay
Set (device control)	→	I 12	HI	Selectable parameters: High, window function, low
		n	1	Transformation ratio factor external current transformer
		🔒	off	Parameter setting via password
		FAC	-	Re-establish factory settings
		SYS	-	Function blocked
InF	→		-	Display hard / software version

Menu	Sub Menu	Menu item	Activation	Adjustable parameter
HiS	→	Clr	-	History memory for the first alarm value, erasable

5.4 Display in standard mode

By default, the currently measured residual current is displayed. The current response values I1 (prewarning) and I2 (alarm) can be displayed using the Up and Down key. Press the enter key to return to the measured value.

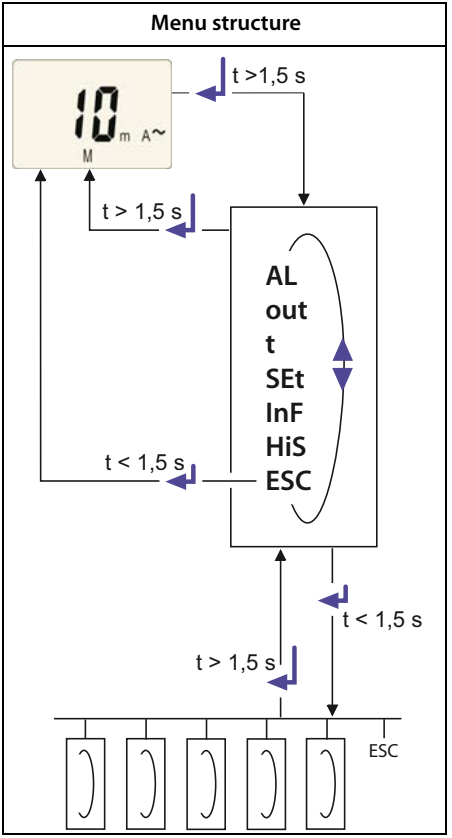


In the standard mode, the currently set response values I1 and I2 can be displayed using the Up and Down keys.

5.5 Display in menu mode

5.5.1 Parameter query and setting: Overview

Menu item	Adjustable parameter
AL	Response values query and setting: – Residual current $I_{\Delta n2}$ (AL2) – Residual current $I_{\Delta n1}$ (AL1) – Hysteresis of the response values: % Hys
out	Configuration of the fault memory and the alarm relays: – Activating/deactivating the fault memory – Select N/O operation (n.o.) or N/C operation (n.c.) for K2 (does not apply to option M) – Specify the number of the reload cycles – Select output signal (does not apply to Op. M2C, M3C) – Assign the alarm category $I_{\Delta n1}$ or $I_{\Delta n2}$, relay test or device error to K2 (2, r2) (does not apply to option M) – Select 100% value related to the output signal (AnA)
t	Set delays: – Response delay t_{on2} (does not apply to option M) – Starting delay t – Delay on release t_{off} (LED, relay) (does not apply to option M)
SEt	Device control parameter setting: – Select the appropriate parameter for response values: overcurrent (HI), undercurr. (Lo) or window function (In). – Set the correction factor (n) for the 2nd measuring current transformer – Enable or disable password protection, change the password – Re-establish factory settings – Service menu SyS blocked
InF	Query hard and software version
HiS	Query the first stored alarm value
ESC	Move to the next higher menu level (back)


Menu structure
10
m A~
M
t >1,5 s
t > 1,5 s
AL
out
t
SEt
InF
HiS
ESC
t < 1,5 s
t < 1,5 s
t > 1,5 s
ESC

Parameter settings

An example is given here on how to change the alarm response value I1 ($I_{\Delta n1}$). It is presumed that the option overcurrent (HI) has been selected in the SEt/I12 menu (factory setting). Proceed as follows:

1. Press the MENU/Enter key for more than 1.5 seconds. The flashing short symbol AL appears on the display.
2. Confirm with Enter. The parameter response value > I2 flashes, in addition the associated overcurrent value > 30 mA appears.
3. Use the Down key to select the parameter response value I1. The parameter I1 flashes, in addition the associated percentage value for prewarning 50 % of I2 appears.
4. Confirm with Enter. The current value for prewarning appears on the flashing display.
5. Use the Up or Down key to set the appropriate response value. Confirm with Enter. I1 flashes.
6. You can exit the menu by:
   - Pressing the Enter key for more than 1.5 seconds to reach the next higher level or
   - selecting the menu item ESC and confirming with Enter to reach the next higher level.

The currently active segments are flashing! In the figures below, the segments where device settings can be carried out are highlighted by an oval. The menu mode can be reached by pressing the MENU key for more than 1.5 seconds.

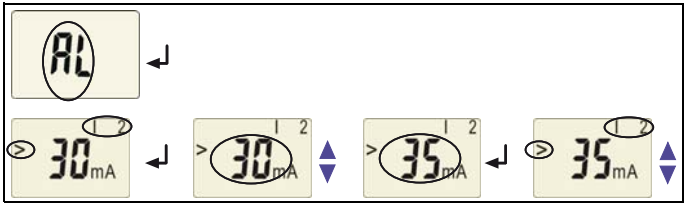
5.5.2 Changeover from overcurrent to undercurrent operation or to window operation

The operating mode can be set in the SEt/I12 menu using the parameters HI, Lo and In. By default, overcurrent operation (HI) is set. Refer to Seite 37 for a detailed description on how to change over to window operation.

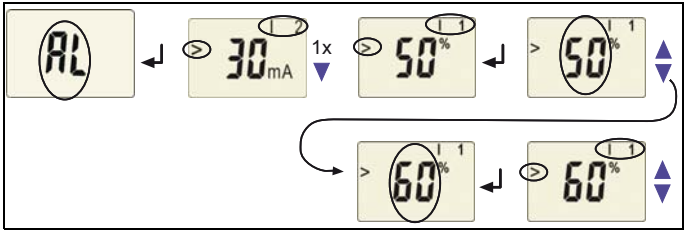
5.5.3 Response value setting for overcurrent:

- Response value I2 (overcurrent)
- Response value I1 (overcurrent)
- Hysteresis (Hys) of the response values I1, I2

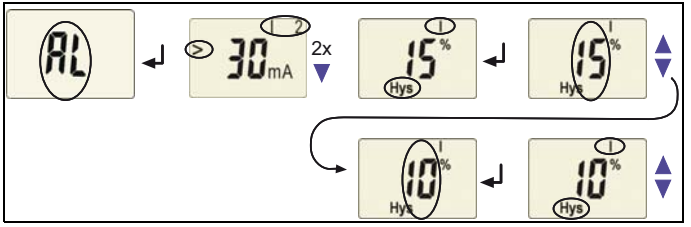
Increasing the response value I2 (Example: overcurrent)



Increasing the response value I1 (prewarning overcurrent)

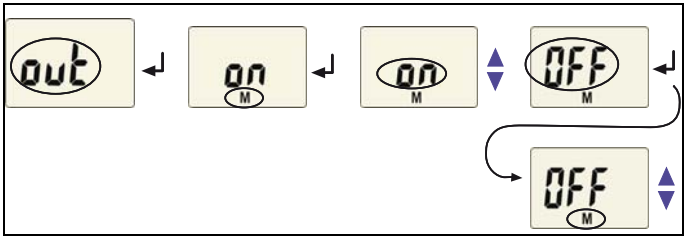


Setting the hysteresis of the response value



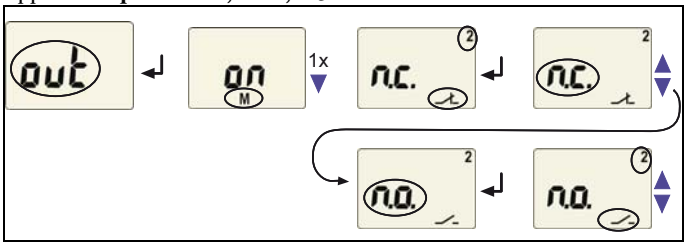
5.5.4 Setting the fault memory and alarm relay operating mode

Deactivating the fault memory

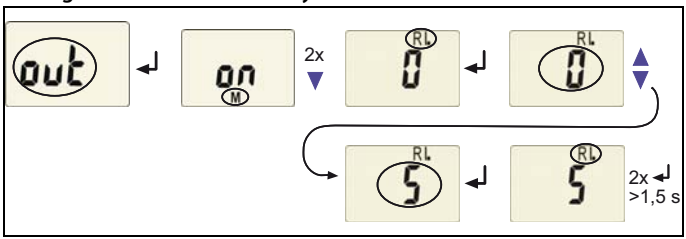


Setting the alarm relay K2 to N/O operation (n.o.)

Applies to **option M1C, M2C, M3C**

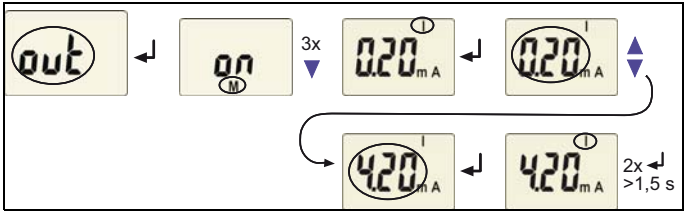


Setting the number of reload cycles



5.5.5 Select output current range of the analogue interface

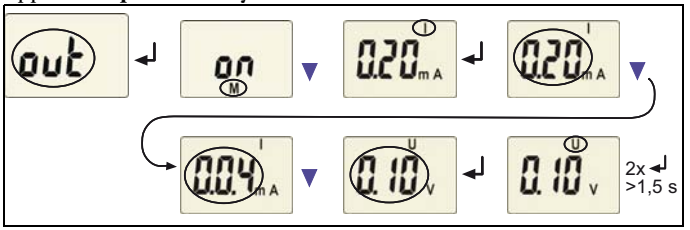
Applies to **option M and M1C**



0.20 mA means 0...20 mA
4.20 mA means 4...20 mA

5.5.6 Select output current and output voltage range of the analogue interface

Applies to **option M only**.

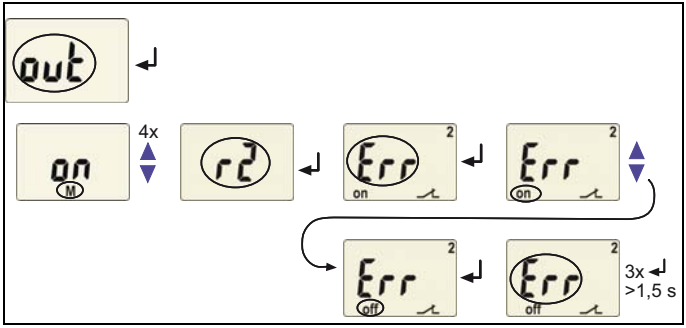


5.5.7 Assigning alarm categories to the alarm relays

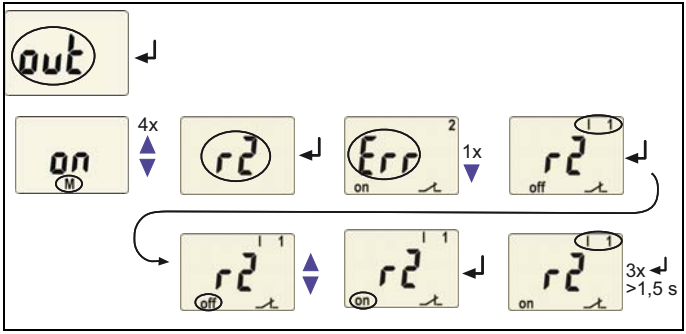
Applies to **option M1C, M2C, M3C only**.

Overcurrent, undercurrent and device-related errors of the residual current monitor can be assigned to the alarm relay K1 K2 (r2, 2). By default, the alarm relay K2 signals in case of overcurrent and device-related errors.

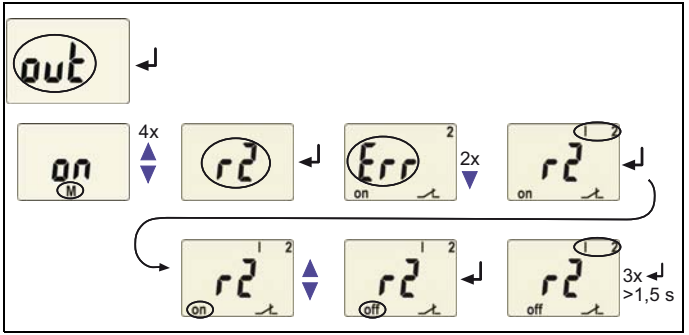
Alarm relay K2: Deactivating the category device error



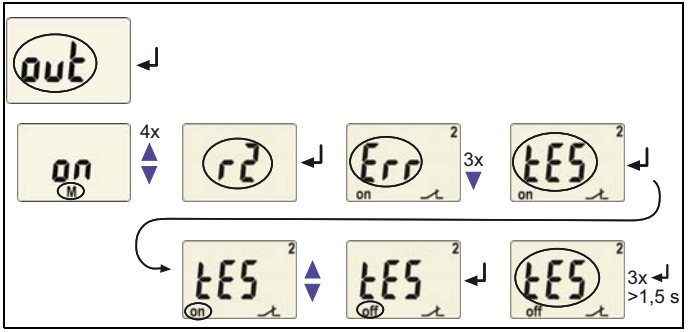
Alarm relay K2: Activating the category response value I1



Alarm relay K2: Deactivating the category response value I2



Alarm relay K2: Deactivating the category device test

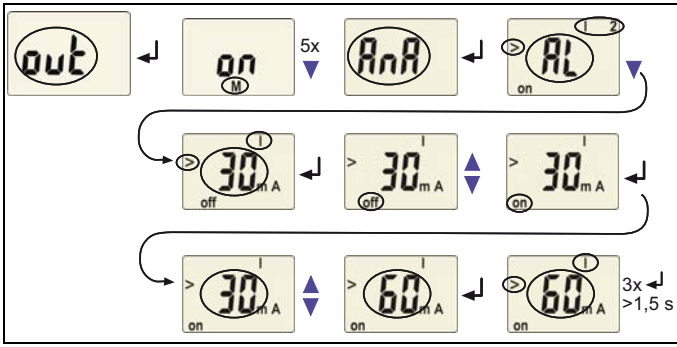


When the alarm relay K2 has been deactivated in the menu, an alarm will not be signalled by the respective changeover contact! An alarm will only be indicated by the respective alarm LED (AL1/AL2)!

5.5.8 Set 100% value related to the analogue interface

Set here whether the 100% value of the output signal is to be referred to response value I2 ($I_{\Delta n2}$) (AL) or to a freely configurable value. Select the appropriate value from the range 10 mA...10 A.
Factory setting = related to the response value I2 ($I_{\Delta n2}$) (AL).

The example below shows how to change the 100% reference of AL = related to the response value to a 100% value of 60 mA.



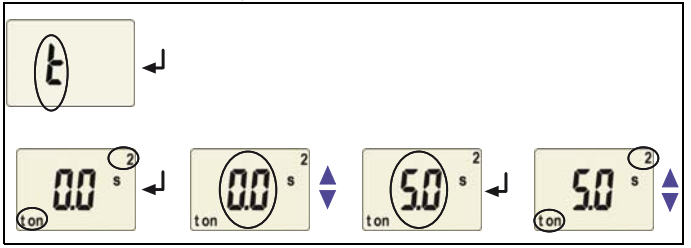
5.5.9 Set the time delays

The following delays can be set:

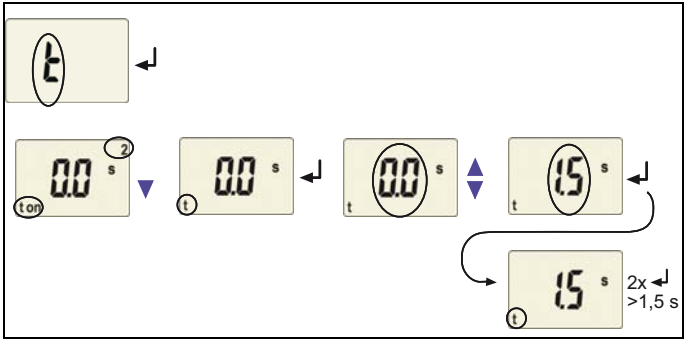
- Response delay t_{on2} (0...10 s) for K2
- Starting delay t (0...10 s) when the device is being started
- Delay on release t_{off} (0...99 s) for K2. The setting t_{off} is only relevant when the fault memory M is deactivated.

The operating steps for the setting of the response delay t_{on2} and the starting delay t are illustrated by way of example.

Set the response delay t_{on2}

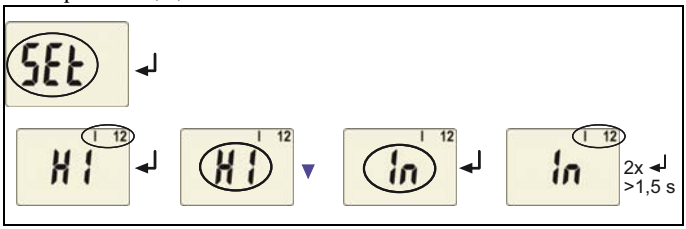


Set the starting delay t

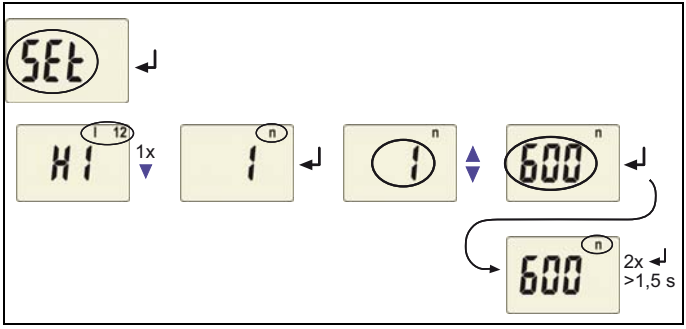


5.5.10 Changing from overcurrent operation to window operation

Use this menu item to set whether the response values of the device apply to overcurrent (HI) or undercurrent operation (Lo). In addition, window operation (In) can be selected.



5.5.11 Setting the correction factor for an additional cascaded current transformer.

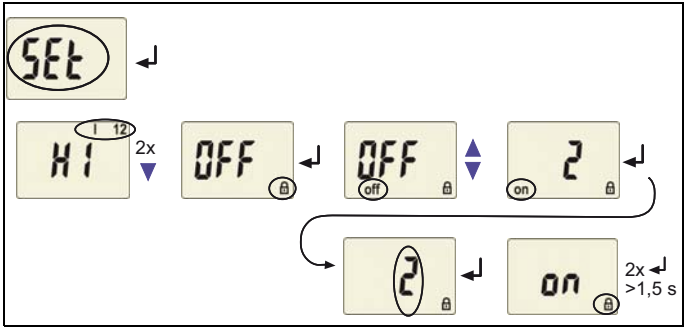


Factory setting without cascaded transformer: n = 1.

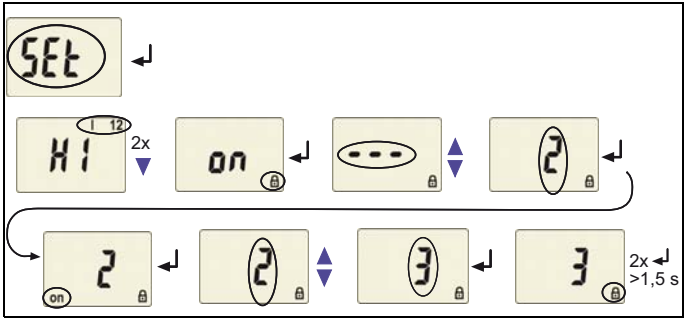
5.5.12 Factory setting and password protection

Use this menu to activate the password protection, to change the password or to deactivate the password protection. In addition, you can use this menu to reset the device to its factory settings.

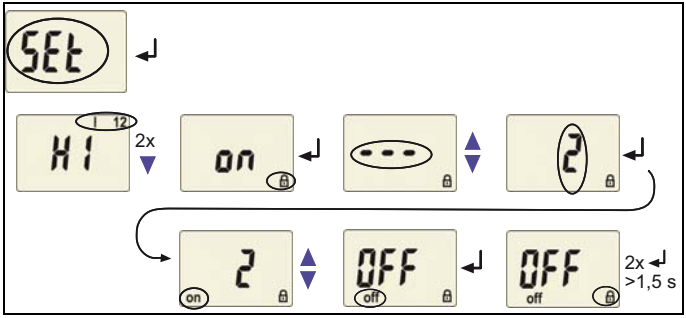
a) Activating the password protection



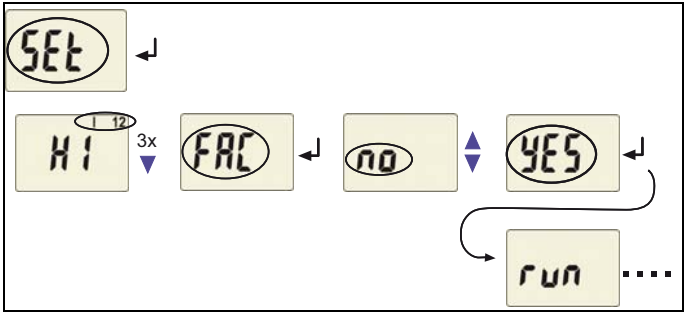
b) Changing the password



c) Deactivating the password protection

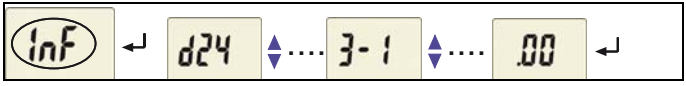


5.5.13 Re-establishing the factory settings



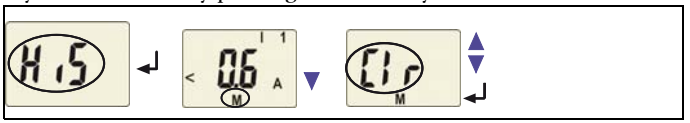
5.5.14 Device information query

This function is used to query the software (1.xx) version. After activating this function, data will be displayed as a scrolling text. Once one pass is completed you can select individual data sections using the Up/Down keys.



5.5.15 History memory query

The history memory can be selected via the menu HiS. Use the Up and Down keys to view the next display. If Clr is flashing, the history memory can be cleared by pressing the Enter key.



5.6 Commissioning and testing

Prior to commissioning, check proper connection of the residual current monitor.

Factory setting

Response value $I_{\Delta n2}$:	*30 mA (I2)*
Response value $I_{\Delta n1}$:	*50 % (I1)*
Hysteresis:	*15 %*
Fault memory M:	*activated*
Operating principle K2 (Err, $I_{\Delta n2}$, tES):	*N/C operation (n.c.)*
RL (Reload function):	*0*
100 % value related to the analogue interface:	*Response value I2*
Response delay K2:	*t_{on2} = 0 s*
Starting delay:	*t = 0.5 s*
Delay on release K2:	*t_{off} = 1.0 s*
Transformer correction factor n (n_{RCM})	*1*
Password query:	*0, Off*

6. Technical data

6.1 Data in tabular form

( )* = factory setting

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage ..... 250 V
Rated impulse voltage/pollution degree ..... 4 kV / III
Protective separation (reinforced insulation) between: ..... (A1, A2) - (k/l, T/R) - (21, 22, 24)
Voltage test according to IEC 61010-1 ..... 2.21 kV

Supply voltage

RCM420-D...-1:
Supply voltage U_s ..... AC 16...72 V / DC 9.6...94 V
Frequency range U_s ..... 42...460 Hz
RCM420-D...-2:
Supply voltage U_s ..... AC/DC 70...300 V
Frequency range U_s ..... 42...460 Hz
Power consumption ..... ≤3 VA

Measuring circuit

External measuring current transformer type ..... W..., WR..., WS...
Load ..... 68 Ω
Rated insulation voltage (measuring current transformer) ..... 800 V
Operating characteristic acc. to IEC 62020 ..... type A
Frequency range ..... 42...2000 Hz
Measuring range ..... 3 mA...16 A
Relative uncertainty ..... 0 ... -20 %
Operating uncertainty ..... 0...-30 %

Response values

Rated residual operating current $I_{\Delta n1}$ (prewarning, AL1) ..... 50...100 % x $I_{\Delta n2}$, (50 %)*
Rated residual operating current $I_{\Delta n2}$ (Alarm, AL2) ..... 10 mA...10 A (30 mA)*
Hysteresis ..... 10...25 % (15 %)*

Specified time

Starting delay t ..... 0...10 s (0.5 s)*
Response delay t_{on2} (Alarm) ..... 0...10 s (0 s)*
Delay on release t_{off} ..... 0...99 s (1 s)*
Operating time t_{ae} at $I_{\Delta n} = 1 \times I_{\Delta n1/2}$ ..... ≤ 180 ms
Operating time t_{ae} at $I_{\Delta n} = 5 \times I_{\Delta n1/2}$ ..... ≤ 30 ms
Response time t_{an} ..... $t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b ..... ≤ 300 ms
Number of reload cycles ..... 0...100 (0)*

Cable lengths for measuring current transformers

Single wire ≥ 0.75 mm^2 ..... 0...1 m
Single wire, twisted ≥ 0.75 mm^2 ..... 0...10 m
Shielded cable ≥ 0.75 mm^2 ..... 0...40 m
Recommended cable
(shielded, shield on one side connected to terminal l of the RCM420, not conn. to earth) ..... J-Y(St)Y min. 2 x 0.8
Connection ..... screw terminals

Displays, memory

Display range, measured value ..... 3 mA...16 A
Error of indication ..... ± 15 % / ± 2 digit
Measured-value memory for alarm value ..... data record measured values
Password ..... off / 0...999 (OFF)*
Fault memory alarm relay ..... on / off (off)*

Inputs/outputs

Cable length for external test / reset button ..... 0 . . . 10 m
Voltage output:
No-load voltage (terminals open) ..... ≤ DC 20 V
Voltage output ..... DC 0...10 V
Load ..... ≥ 1 kΩ
Current outputs:
Short-circuit current ..... ≤ 30 mA, short-circuit proof
Current output ..... DC 0/4...20 mA
Load ..... ≤ 500 Ω
Current output ..... DC 0...400 µA

Load ..... ≤ 12,5 kΩ

Switching elements

Number of switching elements ..... 2 x 1 changeover contact
Operating principle ..... N/C operation n.c. / N/O operation n.o. (N/C operation n.c.)*
Electrical service life under rated operating conditions ..... 10000 switching operations
Contact data acc. to IEC 60947-5-1:

Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230V	230V	24V	110V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A

Minimum contact load ..... 1 mA at AC / DC ≥ 10 V

Environment/EMC

EMC ..... IEC 62020
Operating temperature ..... -25 °C...+55 °C
Classification of climatic conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) ..... 3K5 (except condensation and formation of ice)
Transportation (IEC 60721-3-2) ..... 2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1) ..... 1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:
Stationary use (IEC 60721-3-3) 3M4
Transportation (IEC 60721-3-2) 2M2
Storage (IEC 60721-3-1) 1M3

Connection

Connection ..... screw terminals
Connection properties:
rigid/ flexible/ conductor sizes ..... 0.2...4 / 0.2...2.5 mm^2 / AWG 24...12
Multi-conductor connection (2 conductors with the same cross section):
rigid/ flexible ..... 0.2...1.5 mm^2 / 0.2...1.5 mm^2
Stripping length ..... 8...9 mm
Tightening torque ..... 0.5...0.6 Nm

Other

Operating mode ..... continuous operation
Mounting ..... any position
Protection class, internal components (DIN EN 60529) IP30

Degree of protection, terminals (DIN EN 60529) IP20
Enclosure material ..... polycarbonate
Flammability class UL94 V-0
DIN rail mounting acc. to ..... IEC 60715
Screw fixing ..... 2 x M4 with mounting clip
Software version D240 V1.1x
Weight ..... ≤ 160 g
( )* = factory setting

6.2 Standards, approvals and certification

6.3 Ordering information

	RCM420-D...-1	RCM420-D...-2
Response range $I_{\Delta n}$	10 mA...10 A	10 mA...10 A
Rated frequency	42...2000 Hz	42...2000 Hz
Measuring current transformers	W..., WR..., WS... series	W..., WR..., WS... series
Supply voltage Us*	DC 9.6 V...94 V / AC 42...460 Hz, 16...72 V	DC 70...300 V / AC 42...460 Hz, 70...300 V
Art. No. :		
- Option M	B 9401 4005	B 9401 4010
- Option M1C	B 9401 4007	B 9401 4012
- Option M2C	B 9401 4008	B 9401 4013
- Option M3C	B 9401 4009	B 9401 4014
*Absolute values of the voltage range		

External measuring current transformers

Type	Inside diameter (mm)	Art. No.
W20	20	B 9808 0003
W35	35	B 9808 0010
W60	60	B 9808 0018
W120	120	B 9808 0028
W210	210	B 9808 0034
WR70x175	70 x 175	B 9808 0609
WR115x305	115 x 305	B 9808 0610
WS50x80	50 x 80	B 9808 0603
WS80x120	80 x 120	B 9808 0606

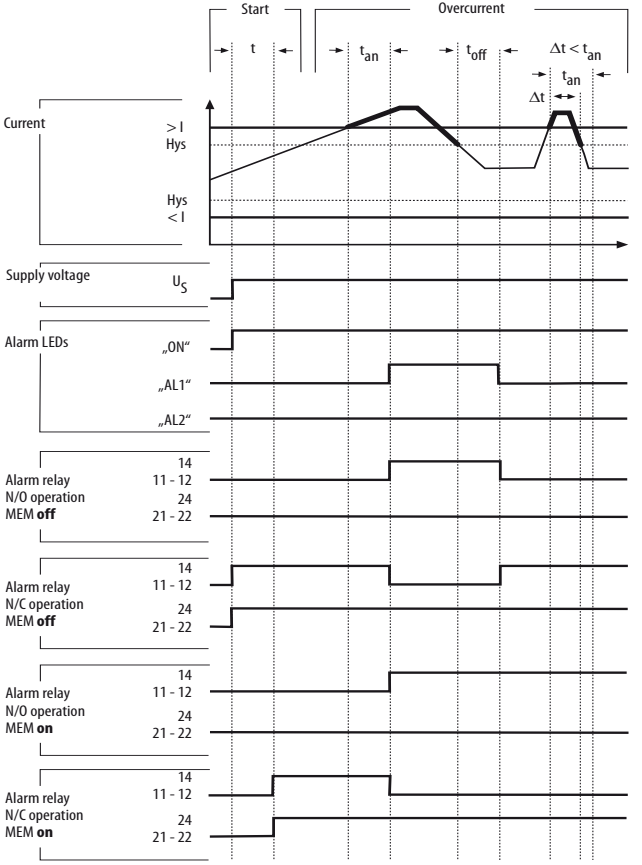
RCM420 accessories

Mounting clip for screw fixing (1 piece per device) ..... B 9806 0008

Measuring current transformers accessories

Snap-on mounting for DIN rail: W20... /W35... ..... B 9808 0501
Snap-on mounting for DIN rail: W60 ..... B 9808 0502

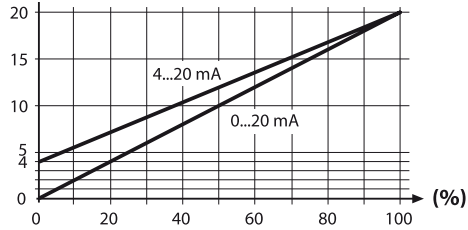
6.4 Timing diagram: Overcurrent monitoring



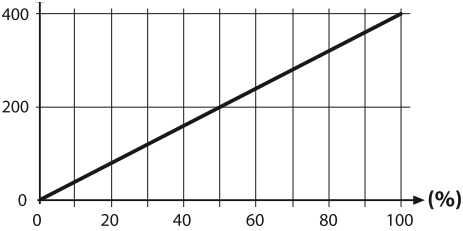
t = starting delay, t_{an} = response time, t_{off} = delay on release

6.5 Current and voltage curves of the analogue interface

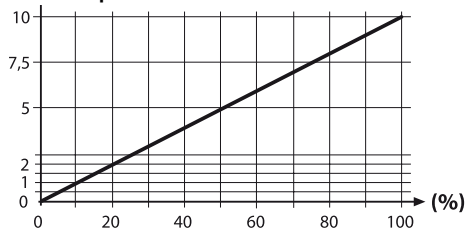
Current output 0/4...20 mA



Current output 0...400 µA



Current output 0...10 V



6.6 Error codes

Should, contrary to all expectations, a device error occur, error codes will appear on the display. Typical error codes are described below:

Error code	Meaning:
E.01	Fault CT connection monitoring Appropriate action: Check CT connection for short-circuit or interruption. After eliminating the fault, the error code will be automatically deleted.
E.02	Fault CT connection monitoring during manual self test. Appropriate action: Check CT connection for short-circuit or interruption. After eliminating the fault, the error code will be automatically deleted.
E....	Appropriate action when error codes > 02 occur: Appropriate action: Carry out a reset. Reset the device to factory setting. After eliminating the fault, the error code will be automatically deleted. If the fault continues to exist, please contact the BENDER Service.

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